

Ted A. Loxley
Serial No. 09/490,162

Docket No. 104

R E M A R K S

No fee is required for this amendment under 37 CFR 1.312 pointing out an inherent advantage of the invention that can be extremely important in the fabrication of nanoscale CMOS microchips using sub-90 nm technologies.

This application has been restored to pending status as the result of a successful petition.

Silicon CMOS has emerged over the last 30 years as the predominant technology of the microelectronics industry as discussed in detail in the paper entitled "Nanoscale CMOS" reproduced on pages 537 to 570 of "Proceedings of the IEEE, Vol. 87, No. 4, April 1999". That paper examines the apparent limits, possible extensions, and applications of CMOS technology in the nanometer regime. It predicts that bulk CMOS in production will continue to improve at its historical pace in the coming decade.

That prediction was conservative and is confirmed by recent publications, such as the article entitled "Front-end Wafer Cleaning Challenges" (Semiconductor International, October 1, 2004) and the report entitled "SCP Jumps Into the Single Wafer Fray" (Electronic News, December 3, 2004). As device feature size continues to shrink (currently at 90 nm and expected to shrink to 25 nm by the year 2011 (The International Technology Roadmap for Semiconductors, 2000), the removal of nanoscale particles presents tremendous challenges to the industry.

One of those challenges is a serious problem with typical megasonic transducers which can damage a 92 nm wafer as

shown by the aforesaid article (10/1/2004). The recent December article (Electronic News) states "A lot of fabs have already shut off their megasonics at 0.25 micron". Another option is to employ advanced low-power non-damaging megasonics that is less effective but more gentle on the wafer. A wet wafer cleaning process with either weakened or deactivated megasonics would be unacceptable during CMOS fabrication unless combined with the electropurge process of the present invention (e.g., to effect essentially complete removal of sub 0.03-micron killer particles).

It should be manifest that the ability to remove sub 0.3-micron and colloidal size particulates effectively without megasonic assistance as described in the last paragraph of page 56 hereof will soon become critically important in the industry and that the present amendment is appropriate.

Entry of this amendment is requested.

Respectfully submitted,



Vincent A. Greene
Vincent A. Greene
Registration No. 17,389
25931 Euclid Avenue
Cleveland, Ohio 44132
Telephone: (216) 481-7772

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Replacement paragraph showing changes made

In the practice of the present invention electropurge cleaning with low-voltage wafer charges, such as 2 to 8 volts, can be effective with the dilute RCA and ultra-dilute RCA (SC-1 and SC-2 cleans with or without the assistance of megasonic energy (which can be damaging to delicate nanoscale micro-circuits).